

REMARKS

This amendment is being filed in response to the Office Action having a mailing date of September 10, 2003. Claims 1-19 are amended. More specifically, independent claims 1, 7, 11, and 17-19 are amended to recite certain distinctive features. Furthermore, claims 1-13 and 17-19 are amended to clarify that certain elements recited in these claims do not fall within 35 U.S.C. § 112, sixth paragraph. New dependent claims 20-22 have been added. No new matter has been added. With this amendment, claims 1-22 are pending in the application.

In the Office Action, claims 1-19 were rejected under 35 U.S.C. § 102(b) as being anticipated by Puhl (U.S. Patent No. 4,629,829). For the reasons set forth below, the applicant respectfully disagrees and requests that all of the pending claims be allowed.

A disclosed embodiment will now be discussed in comparison to the applied references. Of course, the discussion of the disclosed embodiment, and the discussion of the differences between the disclosed embodiment and subject matter described in the applied references, do not define the scope or interpretation of any of the claims. Instead, such discussed differences are intended to merely help the Examiner appreciate important claim distinctions discussed thereafter.

One embodiment involves an improved cancellation technique that can be employed by a server modem in a digital communication system. The echo cancellation technique can provide for cancellation of echo signals imparted on received signals of a modem and also for cancellation of various non-linearities that are present in transmit circuitry. *See, e.g.*, the Abstract, Figures 3-7, and the accompanying description in the present application. Due to the existence of linear system element 506a and non-linear system element 506b within transmit circuitry 306, typical echo cancelers cannot completely compensate for the effects of non-linearities (*i.e.*, linear echo cancelers can only be adapted to the linear system 506a, and thus, the non-linearities present in the non-linear system element 506b cannot be eliminated by the prior art techniques).

Therefore, in accordance with one example embodiment, an echo canceler 512 is suitably configured to be based upon or otherwise reflects the transfer function of a line coupling 308, thereby effectively canceling the non-linearities 506b. *See, e.g.*, page 15, lines 17-22

through page 16, lines 1-10, and Figures 3 and 5 of the present application. Thus, with such an echo canceler 512 (or 310, 710, or 711), the echo signal imparted on a received signal is canceled, as well as the non-linearities present within the transmit circuitry 306 (or 502 or 706). In one of these embodiments, the transfer function E of the echo canceler is equal to the transfer function H of the line coupling 308 (or 508 or 708). The line coupling element 508 having a transfer function H can be represented by a termination resistor, an input impedance, and an effective impedance of the transmission line (such as depicted in Figure 4 for the line coupling 308). The line coupling, for example, couples the server modem 300 to a client communication device 324 (such as a DSL modem).

Puhl, in contrast to what the applicant has disclosed, relates to a different type of device. Puhl relates to a full duplex speaker phone, and does not disclose the same features as disclosed by the applicant. For example, there is nothing disclosed, taught, or suggested by Puhl that relates to an echo canceler having a transfer function that is based upon a transfer function of a line coupling. As described above, the applicant uses such an echo canceler to effectively cancel the non-linearities of the transmit circuitry.

Puhl has no such echo canceler. While Puhl does describe non-linear matching circuitry 503 and 501, such non-linear matching circuitry does not have a transfer function that is based upon the transfer function of the line coupling. Rather, the transfer function of this non-linear matching circuitry is equivalent to the transfer function of a speaker 113. See, e.g., column 7 and lines 17-22, lines 36-42, and Figures 5 and 7 of Puhl. Having a transfer function that matches the speaker 113 is simply not the same as having a transfer function that is based upon the line coupling.

Claim 1 is directed towards a method for echo cancellation. Claim 1 has been amended to recite that the echo cancellation is performed using an echo canceler having a transfer function that is based upon a transfer function of a line coupling between the first transmitter and the second receiver. As described above, this feature is not disclosed, taught, or suggested by Puhl, since Puhl provides non-linear matching circuitry whose transfer function matches the transfer function of the speaker 113, instead of any sort of line coupling (such as line coupling between modem devices). Therefore, amended claim 1 is allowable over Puhl.

Claim 7 is a method claim directed towards compensating for non-linearities introduced into a digital communication system. Claim 7 is amended to recite that a compensated signal is produced by using an echo canceler having a transfer function that is based upon a transfer function of a line coupling present in the digital communication system. There is no disclosure or suggestion in Puhl of adapting or using any sort of echo canceler having a transfer function that is based upon a transfer function of a line coupling. As described above, Puhl instead matches the transfer function of the non-linear matching circuitry with the transfer function of the speaker 113. This is not the same as recited in amended claim 7. Accordingly, amended claim 7 is now allowable over Puhl.

Independent claim 11 is directed towards a communication device to compensate for non-linearities and echo signals. Claim 11 is amended to recite that the echo canceler has a transfer function that is based upon a transfer function of a line coupling present in the digital communication system. This feature is not disclosed, taught, or suggested by Puhl, and therefore, amended claim 11 is allowable over Puhl.

Independent claims 17-19 are all amended to recite an echo canceler (or use thereof) having a transfer function that is based upon a transfer function of a line coupling. These are features that are not found in or suggested by Puhl, since Puhl uses non-linear matching circuitry that matches the transfer function of the speaker 113, and makes no mention whatsoever of matching the transfer function of a line coupling (such as may be present between modem devices). Accordingly, these independent claims now further recite distinctive features, and are now allowable over Puhl.

New dependent claim 20 recites a possible implementation of the line coupling of claim 19. Support for this new claim can be found, for instance, on page 12, lines 2-5 and Figure 4 of the present application. New claim 20 is allowable over the cited references. New dependent claims 21-22 recite that the transfer function of the echo canceler equals the transfer function of the line coupling, which would be one example situation in which the transfer function of the echo canceler "is based upon" the transfer function of the line coupling. The appropriate fee for these added claims is included with this amendment.

Other amendments are made to dependent claims 3 and 4 in order to make the language therein consistent. Amendments are also made to dependent claims 15 and 16 to clarify the language recited therein.

Overall, none of the references singly or in any motivated combination disclose, teach, or suggest what is recited in the independent claims. Thus, given the above amendments and accompanying remarks, the independent claims are now in condition for allowance. The dependent claims that depend directly or indirectly on these independent claims are likewise allowable based on at least the same reasons and based on the recitations contained in each dependent claim.

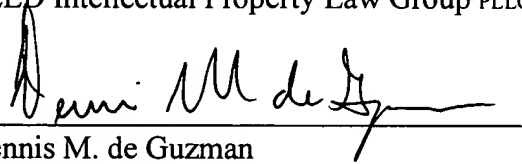
If the undersigned attorney has overlooked a teaching in any of the cited references that is relevant to the allowability of the claims, the Examiner is requested to specifically point out where such teaching may be found. Further, if there are any informalities or questions that can be addressed via telephone, the Examiner is encouraged to contact the undersigned attorney at (206) 622-4900.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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